Idaho Falls Subbasin Assessment and Total Maximum Daily Load

Diversion structure at Dry Bed along the South Fork Snake River, DEQ file photo

Final

Department of Environmental Quality

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2. Subbasin Assessment – Water Quality Concerns and Status

In 1998, DEQ established a new 303(d) list based on 1993-1996 assessments performed through the Beneficial Use Reconnaissance Project (BURP) and other pertinent material regarding beneficial use status and water quality standards violations. Waters monitored through BURP after 1996 have not been assessed for 303(d) listing purposes. The 1998 303(d) list included three (3) stream segments in the Idaho Falls subbasin (Table 7 and Figure 8). The EPA approved that list in May 2000.

2.1 Water Quality Limited Segments Occurring in the Subbasin

It is not entirely clear where is the HUC boundary on the Snake River between this subbasin and the Palisades subbasin (17040104). We have chosen river mile 854.6 because Heise is generally at river mile 851 and it is a site above most canal diversions. The first drainage to the Snake River within the Idaho Falls subbasin is Stinking Spring Canyon. The HUC boundary for Willow Creek is where Willow Creek merges with the Eagle Rock Canal. Although identified on the 303d list as the South Fork Willow Creek, Willow Creek originally did not divide into the South Fork and the North Fork until approximately nine miles downstream of the HUC boundary. Currently, the entire Willow Creek drainage in this subbasin is used as irrigation canals. Flow to the original beds of the South Fork results from diversion of water from the North Fork down the Payne Lateral, and then diverted again into the area of the original South Fork. The original South Fork Willow Creek was only about four to five miles long.

Table 7. §303(d) Segments in the Idaho Falls Subbasin.

Waterbody Name (and Segment ID Number)	AU of HUC 17040201	1998 §303(d)[1] Boundaries	Pollutants	Listing Basis
South Fork Snake River (2003)	SK013_06	Subbasin boundary to Heise	Flow alteration	Carry over from 1996
Birch Creek (5250)	SK008_02 SK008_03	Unnamed tributary in T2N, R41E, Section 2 to sink	unknown	Added to 1998, Low metric scores
South Fork Willow Creek (5655)	SK001_05 SK002_02 SK002_05 SK003_05	Subbasin boundary to Snake River	sediment	Carry over from 1996

[1]Refers to a list created in 1998 of waterbodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

2.2 Applicable Water Quality Standards

Water Quality standards are legally enforceable rules and consist of three parts: the designated uses of waters, the numeric or narrative criteria to protect those uses, and an antidegradation policy. Water quality criteria used to protect these beneficial uses include narrative "free from" criteria applicable to all waters (IDAPA 58.01.02.200), and numerical criteria, which vary according to beneficial uses (IDAPA 58.01.02.210, 250, 251, & 252). Typical numeric criteria include bacteriological criteria for recreational uses, physical and chemical criteria for aquatic life [e.g. pH, temperature, dissolved oxygen (DO), ammonia, toxics, etc.], and toxics and turbidity criteria for water supplies. Idaho's water quality standards are published in the State's rules at *IDAPA 58.01.02 Water Quality Standards and Wastewater Treatment Requirements.* Designated beneficial uses for waters in the Idaho Falls subbasin are listed in Table 8.

Beneficial Uses

Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and "presumed" uses as briefly described in the following paragraphs. The *Water Body Assessment Guidance*, second edition (DEQ 2002) gives a more detailed description of beneficial use identification for use assessment purposes.

Existing Uses

Existing uses under the CWA are "those uses actually attained in the waterbody on or after November 28, 1975, whether or not they are included in the water quality standards." The existing in stream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.003.35, .050.02, and 051.01 and .053). Existing uses include uses actually occurring, whether or not the level of quality to fully support the uses exists. Practical application of this concept would be when a water could support salmonid spawning, but salmonid spawning is not yet occurring.

Designated Uses

Designated uses under the CWA are "those uses specified in water quality standards for each waterbody or segment, whether or not they are being attained." Designated uses are simply uses officially recognized by the state. In Idaho these include things like aquatic life support, recreation in and on the water, domestic water supply, and agricultural use. Water quality must be sufficiently maintained to meet the most sensitive use. Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use such as cold water aquatic life or salmonid spawning. Designated uses are specifically listed for waterbodies in Idaho in tables in the Idaho water quality standards (see IDAPA 58.01.02.003.22 and .100, and IDAPA 58.01.02.109-160 in addition to citations for existing uses.)

Presumed Uses

In Idaho, most waterbodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations. These undesignated uses are to be designated. In the interim, and absent information on existing uses, DEQ presumes that most waters in the state will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called "presumed uses," DEQ will apply the numeric criteria cold water and primary or secondary contact recreation criteria to undesignated waters. If in addition to these presumed uses, an additional existing use, (e.g., salmonid spawning) exists, because of the requirement to protect levels of water quality for existing uses, then the additional numeric criteria for salmonid spawning would additionally apply (e.g., intergravel dissolved oxygen, temperature). However, if for example, cold water is not found to be an existing use, an use designation to that effect is needed before some other aquatic life criteria (such as seasonal cold) can be applied in lieu of cold water criteria. (IDAPA 58.01.02.101.01).

Table 8. Idaho Falls Subbasin designated beneficial uses.

Waterbody	Designated Uses[1]	1998 §303(d) List[2]
Snake River	CW, SS, PCR, AWS, DWS	Yes

[1]CW – Cold Water, SS – Salmonid Spawning, PCR – Primary Contact Recreation, SCR – Secondary Contact Recreation, AWS – Agricultural Water Supply, DWS – Domestic Water Supply
[2]Refers to a list created in 1998 of waterbodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

Table 9. Idaho Falls Subbasin existing/presumed beneficial uses.

Waterbody	Existing/Presumed Uses[1]	1998 §303(d) List[2]
Birch Creek	CW, SS, PCR or SCR	Yes
South Fork Willow Creek	Canal, water conveyance	Yes

[1]CW – Cold Water, SS – Salmonid Spawning, PCR – Primary Contact Recreation, SCR – Secondary Contact Recreation, AWS – Agricultural Water Supply, DWS – Domestic Water Supply
[2]Refers to a list created in 1998 of waterbodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

The Snake River throughout this subbasin is designated for cold water aquatic life, salmonid spawning, primary contact recreation, agricultural and domestic water supplies (Table 8). All other streams in this subbasin are undesignated waters. Birch Creek is presumed to be protected for cold water aquatic life and primary or secondary contact recreation because it is an undesignated water. Salmonid spawning is considered an existing use in Birch Creek as reproducing brook trout were discovered there in 1980 (Table 9). It is not known whether or not that population still exists. The South Fork Willow Creek, as well as the North Fork, are no longer perennial streams, but are used as conveyance systems for irrigation water coming

from Ririe Reservoir and the Snake River (via Eagle Rock Canal). Flow only occurs in the South Fork Willow Creek canal during the irrigation season. Flow in the lower section of the South Fork Willow Creek canal where it enters the Snake River in the city of Idaho Falls, is intermittent daily depending on water diversion schedules and field irrigation demand (see Photos in Appendix).

Of particular importance regarding listed water bodies in this subbasin are the criteria for sediment. The narrative criterion for sediment is as follows:

> "Sediment shall not exceed quantities specified in sections 250 and 252, or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determination of impairment shall be based on water quality monitoring and surveillance and the information utilized in section 350.02.b."

Quantities specified in Section 250 refer to turbidity criteria identified for cold water biota use and small public domestic water supplies. Turbidity must be measured upstream and downstream from a sediment input in order to determine violation of criteria. Indirectly, specific sediment criteria also include intergravel dissolved oxygen measures for salmonid spawning uses. Intergravels filled with sediment cannot hold enough dissolved oxygen for successful incubation. Intergravel dissolved oxygen measurement requires the placement of special apparatus in spawning gravels. Turbidity and intergravel DO are rarely measured as part of routine reconnaissance-level monitoring and assessment. These measurements are usually conducted in special cases during higher-level investigations of potential problems.

Because of the lack of specific numerical criteria for sediment, surrogate measures are often used as a mechanism to reflect potential sediment problems. Often the percentage of depth fine sediments found in spawning gravels is used as an indicator of sediment problems that will affect salmonid species. Generally, depth fines greater than 28-30% is considered unhealthful for spawning gravels. Bank stability can be another indicator of sediment problems in streams. When bank stability falls below 80%, these banks may be contributing unhealthy levels of sediment to aquatic habitats. There are other surrogate measures for sediment, however, caution is advised as specific levels can be highly variable depending on stream morphology and geology of the area, and it may be difficult to pinpoint levels that are universally acceptable.

2.3 Summary and Analysis of Existing Water Quality Data

Very little water quality data exists for the 303d listed stream segments in this subbasin.

Flow Characteristics

There are a series of diversion structures along the South Fork Snake River in the vicinity of Heise. These canals take water from the river and deliver it to the farming regions on the East Side of Idaho Falls. Diversions include Riley Ditch, Anderson Canal, Eagle Rock Canal, Farmers Friend Canal, Enterprise Canal, and Dry Bed Canal. Photographs of some of these diversions are in Appendix D. Dry Bed is the largest diversion in this area.

The basis for the 303d listing for flow alteration of 3.6 miles of the South Fork Snake River in the Idaho Falls subbasin is presumably related to control by Palisades Dam. The diversions in the Heise area are side channel diversions, which do not preclude river flow in this area.

Willow Creek in the Idaho Falls subbasin has not been assessed, as its current use is an irrigation canal. Progressive Irrigation is responsible for and distributes all the water in the Willow Creek canal system (Steve Smith, Personal Communication) (see photographs in Appendix). Gaging station flow records indicate that all the water is shut off to this section of the Willow Creek canal during the non-irrigation season (Table 5).

Water Column Data

To our knowledge, no water column data exist for listed streams in this subbasin.

Biological and Other Data

Birch Creek was listed for unknown pollutants in the 1998 303d list. However, because the primary activities in the drainage are grazing, roads, and dryland agriculture, it is likely that sediment is the pollutant of concern. Percent fine particles were fairly high in the two BURP samples (37% in upper site, 69% in lower site). Photographs taken in July 2001 (Appendix D) show evidence of downcutting, bank sloughing, and siltation in the lower watershed. Steve Smith (Personal Communication) of the Soil Conservation Commission indicated that a single event, locally heavy thunderstorm in the recent past caused much of the present downcutting to Birch Creek.

Status of Beneficial Uses

During the development of DEQ's large river assessment protocol, the South Fork of the Snake River near Heise was selected by researchers at Idaho State University as a reference site for testing their assessment metrics (Royer and Minshall, 1996). Additionally, this site on the South Fork had a DEQ River Fish Index (RFI) of 83 out of a possible 100, a score symbolic of least-disturbed reference river sites (Grafe, 2000).

Only two streams in the subbasin were assessed through the Beneficial Use Reconnaissance Program (BURP) [see Appendix E]. Birch Creek was assessed as not supporting cold water biota aquatic life, and was added by DEQ to the 1998 303d list for Idaho (Table 10). Kelly Canyon Creek was visited twice through BURP, but only the lower site visited in 1996 was assessed (Table 11). Kelly Canyon Creek was not included on the 1998 303d list presumably because of the reasonably high (4.84) macroinvertebrate (MBI) score used at that time. Both Birch Creek and Kelly Canyon Creek have very low flows, generally less than one cubic foot per second at the time of sampling. It is questionable whether these streams are perennial or intermittent.

Table 10. Birch Creek BURP Assessment

BURP Site Location	1998 303d Assessment	MBI Score	SMI Score	SHI Score	Flow (cfs)	Year
Upper Birch Creek – near headwaters	CWB – not fully supported	3.73	47.19 (2)	39 (1)	0.7	1994
Lower Birch Creek – 2+ miles upstream of Highway 26	CWB – not fully supported	1.98	26.24 (Min. Threshold)	51 (1)	0.6	1994

Table 11. Kelly Canyon Creek BURP Assessment

BURP Site Location	1998 303d Assessment	MBI Score	SMI Score	SHI Score	Flow (cfs)	Year
Lower Kelly Canyon – below reservoir near canyon mouth	CWB – needs verification	4.84	57.91 (2)	48 (1)	1.1	1996
Upper Kelly Canyon – above reservoir	NA	3.55	20.7 (Min. Threshold)	65 (3)	0.3	1997

Conclusions

The Snake River between the eastern boundary of the subbasin and the Dry Bed diversion structure is listed for flow alteration, presumably because of the presence of the diversion and flow control from Palisades Reservoir to the east. Flow alteration is not a conventional pollutant for which TMDLs are written. Idaho DEQ and EPA have agreed that TMDLs cannot be written for such "pollution," however, flow altered streams will remain on the 303d list maintained by the state.

Other than Beneficial Use Reconnaissance Program (BURP) assessments, no data exists on the water quality of Birch Creek. Listed for unknown pollutants, it is assumed that sediment from bank erosion is the primary concern in Birch Creek. Birch Creek is very similar to the adjacent Antelope Creek in the Palisades subbasin. The Antelope Creek sediment TMDL will form the basis for the Birch Creek sediment TMDL as a surrogate until such data are collected for Birch Creek.

The South Fork of Willow Creek (which included the North Fork and Willow Creek proper from Eagle Rock Canal to the forks), currently listed for sediment, is a water conveyance system maintained by a local canal company. No water quality data exists for this canal. Water is conveyed through portions of the old stream system during the irrigation season, although the majority of this system has been altered, straightened, and rip-rapped. No TMDLs will be performed for this canal.

2.4 Data Gaps

The hydrology of the Idaho Falls subbasin is predominantly associated with the Snake River and its associated diversions and canal systems. Very few natural streams exist within the subbasin. Of those few streams, Birch Creek is a very small perennial stream draining through an area that is largely in dryland agriculture land use. Because of its small size (less than 1 cfs when assessed through BURP) there has been little interest in doing water quality monitoring. Birch Creek also does not discharge to a natural water body but terminates at the Anderson Canal. Thus any excess sediment delivery from Birch Creek only impacts the maintenance of that canal.

Birch Creek probably carries a substantial (compared to its low flow conditions) snowmelt runoff flow for several weeks in spring. The bulk of its sediment erosion from incised banks probably occurs during these spring runoff events. It is unlikely that sediment delivery can be adequately monitored from the water column at such times. However, because of easy access to the stream, good information can be obtained from bank erosion surveys in the future.

3. Subbasin Assessment – Pollutant Source Inventory

3.1 Sources of Pollutants of Concern

Because TMDLs will not be constructed for the listed segment of the Snake River and for the South Fork Willow Creek canal, the majority of the discussion from hereon will address Birch Creek.

Point Sources

There are five NPDES permitted discharge facilities in the subbasin (Table 12) according to EPA's Permit Compliance System (PCS). Likewise, there are three NPDES permitted feedlots and one tanks/components facility (INEEL) in the subbasin, which do not list effluent limits or receiving streams in PCS.

To our knowledge, none of these facilities are located on 303d listed segments, nor do they specifically discharge the listed pollutants of concern (i.e. sediment, flow alteration).

Table 12. NPDES permitted facilities in the Idaho Falls subbasin.

NPDES ID	Facility ID	Name	Receiving Water
ID0021261	IDD092027010	City of Idaho Falls	Snake River
ID0020010	ID0000552950	City of Rigby	Dry Bed
ID0026174	ID0002378719	City of Ririe	Dry Bed (Great Feeder Canal)
ID0026913	IDD984672261	City of Roberts	Roberts Slough
ID0026565	IDD000602631	Pacificorp/DBA Utah Power & Light	Snake River
IDR05A60F	110000600467	U.S. DOE, INEEL	n.a.
IDU000075	000008966680	Robert Swanson Feedlot	n.a.
IDU000072	000008966650	Boyle Land & Livestock	n.a.
IDG010020	000008483410	Skaar Livestock	n.a.

Nonpoint Sources

The majority of sediment delivery to Birch Creek is assumed to be from streambanks. Birch Creek has an incised channel in places, and is especially deep compared to its width in the dryland agricultural region. Presumably, this situation has been exacerbated by increased spring runoff as a result of land use changes. Birch Creek is also paralleled for more than half its distance by a road, which likely also contributes to its increased hydrology.

Pollutant Transport

Nothing is currently known about the transport of sediment through Birch Creek. However, it is likely that the bulk of the sediment comes from streambank erosion during several weeks of high spring flow. Birch Creek terminates at Anderson Canal, thus, no sediment is delivered to another natural waterbody.

3.2 Data Gaps

Point Sources

There are no point sources on listed waterbodies in this subbasin.

Nonpoint Sources

In addition to streambank erosion surveys for Birch Creek, additional information should be gathered on the possibility of overland flow or road contributions of sediment in the area.

4. Subbasin Assessment – Summary of Past and Present Pollution Control Efforts

To our knowledge, there have been no public pollution control efforts in the Birch Creek watershed. However, because a large portion of the watershed is privately owned, there may be private or public-private efforts that have not been documented by us.

5. Total Maximum Daily Load

A TMDL prescribes an upper limit on discharge of a pollutant from all sources so as to assure water quality standards are met. It further allocates this load capacity (LC) among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a wasteload allocation (WLA); and nonpoint sources, which receive a load allocation (LA). Natural background (NB), when present, is considered part of the load allocation, but is often broken out on its own because it represents a part of the load not subject to control. Because of uncertainties regarding quantification of loads and the relation of specific loads to attainment of water quality standards, the rules regarding TMDLs (Water quality planning and management, 40 CFR 130) require a margin of safety (MOS) be a part of the TMDL.

Practically, the MOS is a reduction in the load capacity that is available for allocation to pollutant sources. The natural background load is also effectively a reduction in the load capacity available for allocation to human made pollutant sources. This can be summarized symbolically as the equation: LC = MOS + NB + LA + WLA = TMDL. The equation is written in this order because it represents the logical order in which a loading analysis is conducted. First the LC is determined. Then the LC is broken down into its components: the necessary MOS is determined and subtracted; then NB, if relevant, is quantified and subtracted; and then the remainder is allocated among pollutant sources. When the breakdown and allocation is completed we have a TMDL, which must equal the LC.

Another step in a loading analysis is the quantification of current pollutant loads by source. This allows the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary in order for pollutant trading to occur. Also a required part of the loading analysis is that the LC be based on critical conditions – the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both LC and pollutant source loads vary, and not necessarily in concert, determination of critical conditions can be more complicated than it may appear on the surface.

A load is fundamentally a quantity of a pollutant discharged over some period of time, and is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, the federal rules allow for “other appropriate measures” to be used when necessary. These “other measures” must still be quantifiable, and relate to water quality standards, but they allow flexibility to deal with pollutant loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads, and allow “gross allotment” as a load allocation where available data or appropriate predictive techniques limit more accurate estimates. For certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads.

The Snake River is impaired due to a lack of flow; however, EPA does not believe that flow (or lack of flow) is a pollutant as defined by CWA Section 502(6). Since TMDLs are not required to be established for waterbodies impaired by pollution but not pollutants, a TMDL has not been established for the Snake River for flow.

The South Fork Willow Creek has been altered from its natural state to be a canal. The land surrounding this canal is principally privately owned, as is the water in the canal privately allocated. The South Fork Willow Creek shall be "delisted" from the 303d list.

5.1 Instream Water Quality Targets

The goal of the TMDL is to restore "full support of designated beneficial uses" (Idaho Code 39.3611, 3615) on Birch Creek within the Idaho Falls subbasin and to bring this water into compliance. In this case, Birch Creek is a undesignated water and is presumed to be protective of cold water aquatic life and secondary contact recreation. Birch Creek had a reproducing population of brook trout in the early 1980s, and thus, has salmonid spawning as an existing use. The water quality pollutant of concern for Birch Creek is sediment.

The current state of science does not allow identification of a specific and precise sediment load or loading capacity to meet the narrative criterion for sediment or to fully support beneficial uses of cold water aquatic life and salmonid spawning. All that can be said is that the loading capacity lies somewhere between current loading and levels that relate to natural streambank erosion. We presume that beneficial uses were, or would be, fully supported at natural background sediment loading rates that are assumed to result from at least 80% bank stability. In order to attain beneficial use support, 80% bank stability will determine the erosion conditions to be used as the sediment target for this TMDL. Streambank erosion estimates can be derived from NRCS methodologies.

To improve the quality of spawning substrate and rearing habitat in Birch Creek, it is necessary to reduce the component subsurface fine sediment (<6.35 mm) to below 28% for improved survival and emergence of trout eggs and fry. Less than 28% subsurface fines in spawning gravel will also be a sediment target for this TMDL. This can be measured by using a modified McNeil sediment sampling procedure (McNeil and Ahnell 1964).

Design Conditions

This sediment loading analysis characterizes sediment loads using average annual rates determined from empirical characteristics that develop over time within the influence of peak and base flow conditions. Annual erosion and sediment delivery are functions of climatic variability where above average water years typically produce higher erosion and subsequently higher sediment loads from unstable streambanks. Stable streambanks that provide access of peak flows to floodplains are able to withstand extreme hydrologic events without becoming unstable. Additionally, the annual average sediment load is not distributed equally throughout the year. To quantify the seasonal and annual variability and critical timing of sediment loading, climate and hydrology must be considered. Erosion typically occurs during a few critical months during spring runoff when bankfull flows occur.

Target Selection

Target selection of sediment is supported by existing narrative criteria in water quality standards [IDAPA 58.01.02.200.08].

Sediment targets for this subbasin are based on streambank erosion related to streambank stability of 80%. Loading rates are quantitative estimates expressed in tons/mile/year. Reduction in streambank erosion prescribed in this TMDL is directly linked to the improvement of streambank stability and to riparian vegetation vigor and density adequate to armor streambanks thereby reducing lateral recession. Over time stream channels are expected to regain equilibrium and provide natural mechanisms for trapping sediment and reducing stream energy which in turn reduces stream erosivity and sediment loading.

It is assumed that natural background sediment loading rates from bank erosion equate to 80% bank stability as described by Overton et al. (1995), where banks are expressed as a percentage of the total estimated bank length. Natural condition streambank stability potential is generally 80% or greater for Rosgen A, B, and C channel types in plutonic, volcanic, metamorphic, and sedimentary geology. Therefore, an 80% bank stability target based on streambank erosion inventories shall be the target for sediment load reduction.

Stream substrate size composition can directly impair spawning success, egg survival to emergence, rearing habitat, and fish escapement from spawning gravels. It is necessary to reduce the component of subsurface fine sediment (<6.35 mm) to below 28% to achieve typical salmonid spawning management objectives.

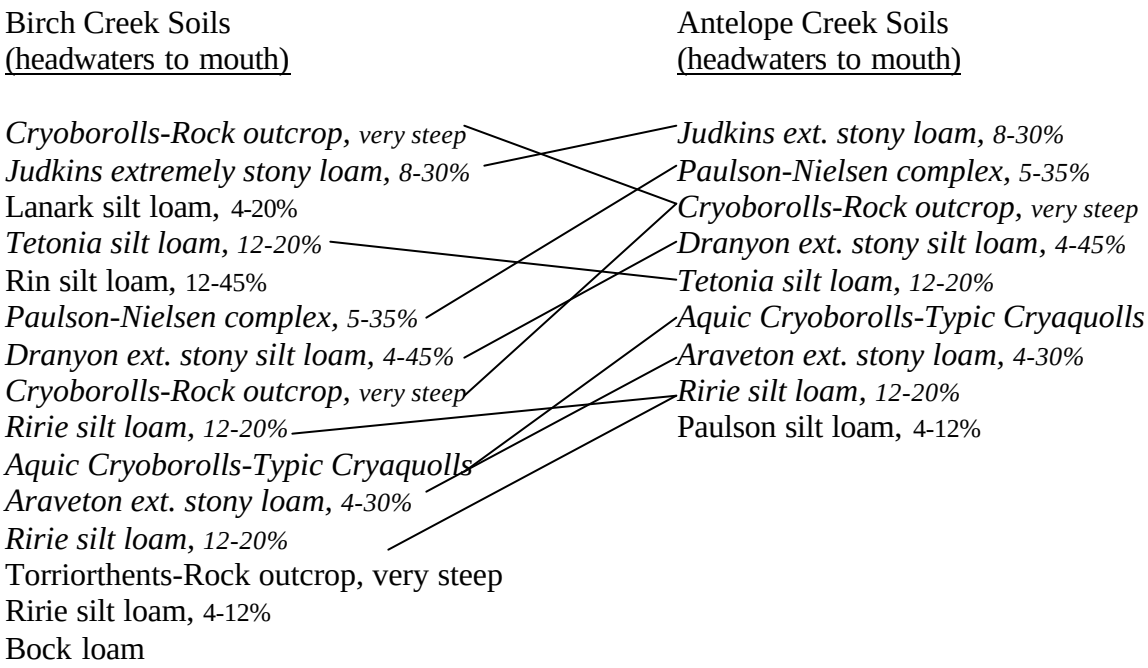
Monitoring Points

No monitoring for streambank erosion or subsurface fines has occurred in Birch Creek. Therefore, monitoring points should be established in spawning gravel or potential spawning gravel presumably in the upper portions of the watershed. Streambank erosion inventories/assessments should be conducted throughout the watershed to evaluate overall bank stability.

5.2 Load Capacity

No data exists for Birch Creek, therefore, a sediment TMDL for Birch Creek must be constructed from another water body used as proxy. In this case, Antelope Creek, which has a sediment TMDL completed in the Palisades Subbasin Assessment and TMDL (Zaroban & Sharp 2001), will provide a useful proxy. Birch Creek and Antelope Creek are nearly adjacent on the same hillside at the tip of the Caribou Range. Both Birch Creek and Antelope Creek share a common geology. The higher elevations of both streams are in Upper Cretaceous thick detrital and fresh-water limestone. With mid- and lower elevations in Pliocene silicic welded tuff ash and flow rocks and Lower Pliestocene silic volcanic units of Island Park-Yellowstone area (Figure 2).

Birch Creek soils are very similar to Antelope Creek soils. Below is a comparison of soils between the two creeks from headwaters to mouth. Those soil names in Italics are common between the two streams.



Aspects are slightly different with Birch Creek flowing northwest and Antelope Creek flowing north and then northwest. However, landuses are very similar, both having shrub/forest grazing lands at higher elevations and dryland farming at lower elevations.

Thus, because no sediment or erosion data are available for Birch Creek, erosion surveys from Antelope Creek will be used as a surrogate loading analysis for Birch Creek. The Palisades Subbasin Assessment and TMDL reported an existing bank stability of 62% and a sediment load for Antelope Creek of 62 tons/mile/year. The loading capacity for that stream was 14.3 tons/miles/year based on an 80% bank stability target. These same loads will be applied to Birch Creek until such time that erosion surveys are complete and more accurate loads can be generated for Birch Creek.

5.3 Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading," (Water quality planning and management, 40 CFR 130.2(I)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the type of sources (land use) and area (such as a subwatershed), but may be aggregated by type of source or land area. To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads.

There are no known point source discharges in the Birch Creek watershed. Existing nonpoint source load of sediment in Birch Creek is expected to be similar to that of adjacent Antelope Creek as explained in the Loading Capacity section above.

Table 13. Wasteloads from point sources in Birch Creek.

Wasteload Type	Location	Load	NPDES[1] Permit Number
n.a.	n.a.	n.a.	n.a.

[1]National Pollutant Discharge Elimination System

Table 14. Loads from nonpoint sources in Birch Creek.

Wasteload Type	Location	Load	Estimation Method
Sediment Load Reduction Based on Average Annual Loading Rate: tons/mile/year	Birch Creek, headwaters to mouth	62 tons/mile/year	Based on 62% bank stability rating for Antelope Creek TMDL

5.4 Load Allocation

The entire sediment load appropriate for Birch Creek (loading capacity) is dedicated to nonpoint sources of pollution. In this case, those nonpoint sources include natural erosion from streambanks that are at least 80% stable.

Margin of Safety

The margin of safety (MOS) factored into sediment load allocations is implicit. The MOS includes the conservative assumptions used to develop existing sediment loads. Conservative assumptions made as part of the sediment loading analysis include: 1) desired bank erosion rates are representative of assumed natural background conditions; 2) water quality targets for percent depth fines are consistent with values measured and set by local land management agencies based on established literature values and incorporate an adequate level of fry survival to provide for stable salmonid production.

Seasonal Variation

Seasonal variability was built-in to this TMDL by developing sediment loads using annual average rates determined from empirical characteristics that developed over time within the influence of runoff events and peak and base flow conditions. Streambank erosion inventories take into account that most bank recession occurs during peak flow events, when the banks are saturated. The estimated annual average sediment delivery is a function of bankfull discharge. It is assumed that the accumulation of sediment within dry channels is continuous until flow resumes and the accumulated sediment is transported and deposited.

Background

Natural background loading rates are assumed to be the natural sediment loading capacity of 80% or greater streambank stability and 28% or less subsurface fine sediment. Therefore natural background is accounted for in the load capacity.

Reserve

An additional 10% of the LC will be allocated as reserve for future nonpoint source sediment activities. No WLA reserve will be imposed.

If it is determined that full beneficial use support is achieved and standards are being met at sediment loading rates higher that those set forth in this TMDL then the reserve and TMDL will be revised accordingly. Conversely, within a reasonable time after full implementation of best management practices, if it is determined that full beneficial use support is not forthcoming and or standards are not being met then additional best management practices will be required and reserve amounts will need to be re-evaluated.

Table 15. Wasteload point source allocations for Birch Creek.

Source	Pollutant	Allocation	Time Frame for Meeting Allocations
NA	NA	NA	NA

Table 16. Load nonpoint source allocations for Birch Creek.

Source	Current Load	Loading Capacity/Load Allocation	Reduction[#]
Birch Creek streambank sediment	62 tons/mile/year	14.3 tons/mile/year	-49.2 tons/mile/year (79% reduction)

10% of the LC is held in reserve, thus an additional 1.43 tons/mile/year are required to be reduced.

5.5 Implementation Strategies

DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that the TMDL goals for restoring full beneficial use support or restoring compliance with water quality standards are not being met or significant progress is not being made toward achieving the goals. Conversely, goals may be met through improvement of riparian management techniques.

Time Frame

DEQ is currently working with private landowners to gain access and establish locations for streambank measurements. These data should be compiled before run-off 2005. The Idaho Soil Conservation Commission will also conduct effectiveness monitoring during and after implementation of sediment reductions on Birch Creek. DEQ anticipates an implementation plan within the next 18 months and on the ground projects throughout the next 3 to 5 years. Beneficial use restoration is expected to be complete in 2013.

The expected time frame for attaining water quality standard and restoring beneficial use is a function of management intensity, climate, ecological potential, and natural variability of environmental conditions. If implementation of best management practices is embraces enthusiastically some improvements may be seen in as little as several years. Even with aggressive implementation, however, some natural processes required for satisfying the requirements of this TMDL may not be seen for many years. The deleterious effects of historic land management practices have accrued over many years and recovery of natural systems may take longer than administrative needs allow for.

Approach

It is anticipated that by improving riparian management practices, overall riparian zone recovery will precipitate streambank stabilization, reduce sedimentation, increase canopy cover, and lower stream temperatures, all of which will precipitate overall stream habitat improvements. Such improvements will contribute to an overall improvement in stream morphology and habitat, shifting stream health towards beneficial use attainment.

Monitoring Strategy

Streambank erosion inventories are intended for rapid assessment, but will allow for the evaluation of streambank condition in the absence of more rigorous evaluation by established federal land management assessment protocol. Stream subsurface fine sediment should continue to be assessed through McNeil sediment core sampling at established intervals to identify trends toward meeting sediment targets. Beneficial Use Reconnaissance Program monitoring will continue to be conducted by DEQ and should also provide insight regarding steam conditions.

5.6 Conclusions

The Snake River and the South Fork Willow Creek are flow altered systems. The Snake River has often been described as a working river, and that is clear in this subbasin. The Snake River flow is controlled above at Palisades Dam, and there are a number of diversion structures in this subbasin for delivering water to the vast fields of the Snake River plain. Willow Creek on the other hand, was converted to be a canal years ago. Flow only occurs during the irrigation season in portions of the old streambed that have been modified, straightened and rip-rap stabilized.

Birch Creek is also affected by flow, in this case natural flow regimes are very low. Birch Creek flow typically drops below one cubic foot per second during summer months. Birch Creek also terminates in a canal and has flow allocated for agricultural diversion.

There are a number of mechanisms by which the full support of aquatic life can be extended to areas that are marginal due to natural variability of flowing water. An important consideration is to create viable refuge in key tributaries for fish and other aquatic species when the flow regime is naturally altered in mainstream waters. In other cases man manages flow for agricultural production and this management has been the established priority over many years prior to the laws that govern environmental quality. The right to divert water for economic benefit is protected as a property right in the laws of the state of Idaho. The potential synergism between natural and anthropogenic flow alteration can severely limit the potential for fisheries and aquatic life in natural systems. The potential also exists, however, for voluntary and cooperative projects to enhance water quality and aquatic life beneficial uses, while concurrently enhancing the availability of water for economic use. This is the overall optimum scenario that should be sought in areas that are today marginal for both uses.

The direct relationship between stream erosion and stream temperatures is apparent with the coupling of sediment and temperature 303(d) listings. Stream channel migration is a natural process that occurs at a slow rate under conditions of sediment equilibrium. Lateral recession is a natural process accompanied by depositional mechanisms that are balanced in a system that is stable and in equilibrium. Streambank erosion, however, can be accelerated by reducing/eliminating riparian vegetation and the detachment of bank material (clumping and sloughing), all of which disrupt the natural stream system contributing to elevated stream sediment and elevation of stream temperature.

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Glossary

305(b)	Refers to section 305 subsection "b" of the Clean Water Act. 305(b) generally describes a report of each state's water quality, and is the principle means by which the U.S. Environmental Protection Agency, Congress, and the public evaluate whether U.S. waters meet water quality standards, the progress made in maintaining and restoring water quality, and the extent of the remaining problems.
§303(d)	Refers to section 303 subsection "d" of the Clean Water Act. 303(d) requires states to develop a list of waterbodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to U.S. Environmental Protection Agency approval.
Acre-Foot	A volume of water that would cover an acre to a depth of one foot. Often used to quantify reservoir storage and the annual discharge of large rivers.
Adsorption	The adhesion of one substance to the surface of another. Clays, for example, can adsorb phosphorus and organic molecules
Aeration	A process by which water becomes charged with air directly from the atmosphere. Dissolved gases, such as oxygen, are then available for reactions in water.
Aerobic	Describes life, processes, or conditions that require the presence of oxygen.
Assessment Database (ADB)	The ADB is a relational database application designed for the U.S. Environmental Protection Agency for tracking water quality assessment data, such as use attainment and causes and sources of impairment. States need to track this information and many other types of assessment data for thousands of waterbodies, and integrate it into meaningful reports. The ADB is designed to make this process accurate, straightforward, and user-friendly for participating states, territories, tribes, and basin commissions.
Adfluvial	Describes fish whose life history involves seasonal migration from lakes to streams for spawning.
Adjunct	In the context of water quality, adjunct refers to areas directly adjacent to focal or refuge habitats that have been degraded by human or natural disturbances and do not presently support high diversity or abundance of native species.

Alevin	A newly hatched, incompletely developed fish (usually a salmonid) still in nest or inactive on the bottom of a waterbody, living off stored yolk.
Algae	Non-vascular (without water-conducting tissue) aquatic plants that occur as single cells, colonies, or filaments.
Alluvium	Unconsolidated recent stream deposition.
Ambient	General conditions in the environment. In the context of water quality, ambient waters are those representative of general conditions, not associated with episodic perturbations, or specific disturbances such as a wastewater outfall (Armantrout 1998, EPA 1996).
Anadromous	Fish, such as salmon and sea-run trout, that live part or the majority of their lives in the salt water but return to fresh water to spawn.
Anaerobic	Describes the processes that occur in the absence of molecular oxygen and describes the condition of water that is devoid of molecular oxygen.
Anoxia	The condition of oxygen absence or deficiency.
Anthropogenic	Relating to, or resulting from, the influence of human beings on nature.
Anti-Degradation	Refers to the U.S. Environmental Protection Agency's interpretation of the Clean Water Act goal that states and tribes maintain, as well as restore, water quality. This applies to waters that meet or are of higher water quality than required by state standards. State rules provide that the quality of those high quality waters may be lowered only to allow important social or economic development and only after adequate public participation (IDAPA 58.01.02.051). In all cases, the existing beneficial uses must be maintained. State rules further define lowered water quality to be 1) a measurable change, 2) a change adverse to a use, and 3) a change in a pollutant relevant to the water's uses (IDAPA 58.01.02.003.56).
Aquatic	Occurring, growing, or living in water.
Aquifer	An underground, water-bearing layer or stratum of permeable rock, sand, or gravel capable of yielding of water to wells or springs.
Assemblage (aquatic)	An association of interacting populations of organisms in a given waterbody; for example, a fish assemblage, or a benthic macroinvertebrate assemblage (also see Community) (EPA 1996).
Assimilative Capacity	The ability to process or dissipate pollutants without ill effect to beneficial uses.
Autotrophic	An organism is considered autotrophic if it uses carbon dioxide as its main source of carbon. This most commonly happens through photosynthesis.

Batholith	A large body of intrusive igneous rock that has more than 40 square miles of surface exposure and no known floor. A batholith usually consists of coarse-grained rocks such as granite.
Bedload	Material (generally sand-sized or larger sediment) that is carried along the streambed by rolling or bouncing.
Beneficial Use	Any of the various uses of water, including, but not limited to, aquatic biota, recreation, water supply, wildlife habitat, and aesthetics, which are recognized in water quality standards.
Beneficial Use Reconnaissance Program (BURP)	A program for conducting systematic biological and physical habitat surveys of waterbodies in Idaho. BURP protocols address lakes, reservoirs, and wadeable streams and rivers
Benthic	Pertaining to or living on or in the bottom sediments of a waterbody
Benthic Organic Matter.	The organic matter on the bottom of a waterbody.
Benthos	Organisms living in and on the bottom sediments of lakes and streams. Originally, the term meant the lake bottom, but it is now applied almost uniformly to the animals associated with the lake and stream bottoms.
Best Management Practices (BMPs)	Structural, nonstructural, and managerial techniques that are effective and practical means to control nonpoint source pollutants.
Best Professional Judgment	A conclusion and/or interpretation derived by a trained and/or technically competent individual by applying interpretation and synthesizing information.
Biochemical Oxygen Demand (BOD)	The amount of dissolved oxygen used by organisms during the decomposition (respiration) of organic matter, expressed as mass of oxygen per volume of water, over some specified period of time.
Biological Integrity	1) The condition of an aquatic community inhabiting unimpaired waterbodies of a specified habitat as measured by an evaluation of multiple attributes of the aquatic biota (EPA 1996). 2) The ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the natural habitats of a region (Karr 1991).
Biomass	The weight of biological matter. Standing crop is the amount of biomass (e.g., fish or algae) in a body of water at a given time. Often expressed as grams per square meter.
Biota	The animal and plant life of a given region.
Biotic	A term applied to the living components of an area.

Clean Water Act (CWA)	The Federal Water Pollution Control Act (commonly known as as the Clean Water Act), as last reauthorized by the Water Quality Act of 1987, establishes a process for states to use to develop information on, and control the quality of, the nation's water resources.
Coliform Bacteria	A group of bacteria predominantly inhabiting the intestines of humans and animals but also found in soil. Coliform bacteria are commonly used as indicators of the possible presence of pathogenic organisms (also see Fecal Coliform Bacteria).
Colluvium	Material transported to a site by gravity.
Community	A group of interacting organisms living together in a given place.
Conductivity	The ability of an aqueous solution to carry electric current, expressed in micro (µ) mhos/cm at 25 °C. Conductivity is affected by dissolved solids and is used as an indirect measure of total dissolved solids in a water sample.
Cretaceous	The final period of the Mesozoic era (after the Jurassic and before the Tertiary period of the Cenozoic era), thought to have covered the span of time between 135 and 65 million years ago.
Criteria	In the context of water quality, numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels, and to limit the number of violations per year. EPA develops criteria guidance; states establish criteria.
Cubic Feet per Second	A unit of measure for the rate of flow or discharge of water. One cubic foot per second is the rate of flow of a stream with a cross-section of one square foot flowing at a mean velocity of one foot per second. At a steady rate, once cubic foot per second is equal to 448.8 gallons per minute and 10,984 acre-feet per day.
Cultural Eutrophication	The process of eutrophication that has been accelerated by human-caused influences. Usually seen as an increase in nutrient loading (also see Eutrophication).
Culturally Induced Erosion	Erosion caused by increased runoff or wind action due to the work of humans in deforestation, cultivation of the land, overgrazing, and disturbance of natural drainages; the excess of erosion over the normal for an area (also see Erosion).
Debris Torrent	The sudden down slope movement of soil, rock, and vegetation on steep slopes, often caused by saturation from heavy rains.

Decomposition	The breakdown of organic molecules (e.g., sugar) to inorganic molecules (e.g., carbon dioxide and water) through biological and nonbiological processes.
Depth Fines	Percent by weight of particles of small size within a vertical core of volume of a streambed or lake bottom sediment. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 6.5 mm depending on the observer and methodology used. The depth sampled varies but is typically about one foot (30 cm).
Designated Uses	Those water uses identified in state water quality standards that must be achieved and maintained as required under the Clean Water Act.
Discharge	The amount of water flowing in the stream channel at the time of measurement. Usually expressed as cubic feet per second (cfs).
Dissolved Oxygen (DO)	The oxygen dissolved in water. Adequate DO is vital to fish and other aquatic life.
Disturbance	Any event or series of events that disrupts ecosystem, community, or population structure and alters the physical environment.
E. coli	Short for *Escherichia Coli*, *E. coli* are a group of bacteria that are a subspecies of coliform bacteria. Most *E. coli* are essential to the healthy life of all warm-blooded animals, including humans. Their presence is often indicative of fecal contamination.
Ecology	The scientific study of relationships between organisms and their environment; also defined as the study of the structure and function of nature.
Ecological Indicator	A characteristic of an ecosystem that is related to, or derived from, a measure of a biotic or abiotic variable that can provide quantitative information on ecological structure and function. An indicator can contribute to a measure of integrity and sustainability. Ecological indicators are often used within the multimetric index framework.
Ecological Integrity	The condition of an unimpaired ecosystem as measured by combined chemical, physical (including habitat), and biological attributes (EPA 1996).
Ecosystem	The interacting system of a biological community and its non-living (abiotic) environmental surroundings.
Effluent	A discharge of untreated, partially treated, or treated wastewater into a receiving waterbody.
Endangered Species	Animals, birds, fish, plants, or other living organisms threatened with imminent extinction. Requirements for declaring a species as endangered are contained in the Endangered Species Act.

Environment	The complete range of external conditions, physical and biological, that affect a particular organism or community.
Eocene	An epoch of the early Tertiary period, after the Paleocene and before the Oligocene.
Eolian	Windblown, referring to the process of erosion, transport, and deposition of material by the wind.
Ephemeral Stream	A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long continued supply from melting snow or other sources. Its channel is at all times above the water table. (American Geologic Institute 1962).
Erosion	The wearing away of areas of the earth's surface by water, wind, ice, and other forces.
Eutrophic	From Greek for "well nourished," this describes a highly productive body of water in which nutrients do not limit algal growth. It is typified by high algal densities and low clarity.
Eutrophication	1) Natural process of maturing (aging) in a body of water. 2) The natural and human-influenced process of enrichment with nutrients, especially nitrogen and phosphorus, leading to an increased production of organic matter.
Exceedance	A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria.
Existing Beneficial Use or Existing Use	A beneficial use actually attained in waters on or after November 28, 1975, whether or not the use is designated for the waters in Idaho's *Water Quality Standards and Wastewater Treatment Requirements* (IDAPA 58.01.02).
Exotic Species	A species that is not native (indigenous) to a region.
Extrapolation	Estimation of unknown values by extending or projecting from known values.
Fauna	Animal life, especially the animals characteristic of a region, period, or special environment.
Fecal Coliform Bacteria	Bacteria found in the intestinal tracts of all warm-blooded animals or mammals. Their presence in water is an indicator of pollution and possible contamination by pathogens (also see Coliform Bacteria).
Fecal Streptococci	A species of spherical bacteria including pathogenic strains found in the intestines of warm-blooded animals.
Feedback Loop	In the context of watershed management planning, a feedback loop is a process that provides for tracking progress toward goals and revising actions according to that progress.
Fixed-Location Monitoring	Sampling or measuring environmental conditions continuously or repeatedly at the same location.

Flow	See Discharge.
Fluvial	In fisheries, this describes fish whose life history takes place entirely in streams but migrate to smaller streams for spawning.
Focal	Critical areas supporting a mosaic of high quality habitats that sustain a diverse or unusually productive complement of native species.
Fully Supporting	In compliance with water quality standards and within the range of biological reference conditions for all designated and exiting beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).
Fully Supporting Cold Water	Reliable data indicate functioning, sustainable cold water biological assemblages (e.g., fish, macroinvertebrates, or algae), none of which have been modified significantly beyond the natural range of reference conditions (EPA 1997).
Fully Supporting but Threatened	An intermediate assessment category describing waterbodies that fully support beneficial uses, but have a declining trend in water quality conditions, which if not addressed, will lead to a "not fully supporting" status.
Geographical Information Systems (GIS)	A georeferenced database.
Geometric Mean	A back-transformed mean of the logarithmically transformed numbers often used to describe highly variable, right-skewed data (a few large values), such as bacterial data.
Grab Sample	A single sample collected at a particular time and place. It may represent the composition of the water in that water column.
Gradient	The slope of the land, water, or streambed surface.
Ground Water	Water found beneath the soil surface saturating the layer in which it is located. Most ground water originates as rainfall, is free to move under the influence of gravity, and usually emerges again as stream flow.
Growth Rate	A measure of how quickly something living will develop and grow, such as the amount of new plant or animal tissue produced per a given unit of time, or number of individuals added to a population.
Habitat	The living place of an organism or community.
Headwater	The origin or beginning of a stream.
Hydrologic Basin	The area of land drained by a river system, a reach of a river and its tributaries in that reach, a closed basin, or a group of streams forming a drainage area (also see Watershed).

Hydrologic Cycle	The cycling of water from the atmosphere to the earth (precipitation) and back to the atmosphere (evaporation and plant transpiration). Atmospheric moisture, clouds, rainfall, runoff, surface water, ground water, and water infiltrated in soils are all part of the hydrologic cycle.
Hydrologic Unit	One of a nested series of numbered and named watersheds arising from a national standardization of watershed delineation. The initial 1974 effort (USGS 1987) described four levels (region, subregion, accounting unit, cataloging unit) of watersheds throughout the United States. The fourth level is uniquely identified by an eight-digit code built of two-digit fields for each level in the classification. Originally termed a cataloging unit, fourth field hydrologic units have been more commonly called subbasins. Fifth and sixth field hydrologic units have since been delineated for much of the country and are known as watershed and subwatersheds, respectively.
Hydrologic Unit Code (HUC)	The number assigned to a hydrologic unit. Often used to refer to fourth field hydrologic units.
Hydrology	The science dealing with the properties, distribution, and circulation of water.
Impervious	Describes a surface, such as pavement, that water cannot penetrate.
Influent	A tributary stream.
Inorganic	Materials not derived from biological sources.
Instantaneous	A condition or measurement at a moment (instant) in time.
Intergravel Dissolved Oxygen	The concentration of dissolved oxygen within spawning gravel. Consideration for determining spawning gravel includes species, water depth, velocity, and substrate.
Intermittent Stream	1) A stream that flows only part of the year, such as when the ground water table is high or when the stream receives water from springs or from surface sources such as melting snow in mountainous areas. The stream ceases to flow above the streambed when losses from evaporation or seepage exceed the available stream flow. 2) A stream that has a period of zero flow for at least one week during most years.
Interstate Waters	Waters that flow across or form part of state or international boundaries, including boundaries with Indian nations.
Irrigation Return Flow	Surface (and subsurface) water that leaves a field following the application of irrigation water and eventually flows into streams.

Key Watershed	A watershed that has been designated in Idaho Governor Batt's *State of Idaho Bull Trout Conservation Plan* (1996) as critical to the long-term persistence of regionally important trout populations.
Knickpoint	Any interruption or break of slope.
Land Application	A process or activity involving application of wastewater, surface water, or semi-liquid material to the land surface for the purpose of treatment, pollutant removal, or ground water recharge.
Limiting Factor	A chemical or physical condition that determines the growth potential of an organism. This can result in a complete inhibition of growth, but typically results in less than maximum growth rates.
Limnology	The scientific study of fresh water, especially the history, geology, biology, physics, and chemistry of lakes.
Load Allocation (LA)	A portion of a waterbody's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).
Load(ing)	The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.
Loading Capacity (LC)	A determination of how much pollutant a waterbody can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, and a margin of safety, it becomes a total maximum daily load.
Loam	Refers to a soil with a texture resulting from a relative balance of sand, silt, and clay. This balance imparts many desirable characteristics for agricultural use.
Loess	A uniform wind-blown deposit of silty material. Silty soils are among the most highly erodible.
Lotic	An aquatic system with flowing water such as a brook, stream, or river where the net flow of water is from the headwaters to the mouth.
Luxury Consumption	A phenomenon in which sufficient nutrients are available in either the sediments or the water column of a waterbody, such that aquatic plants take up and store an abundance in excess of the plants' current needs.
Macroinvertebrate	An invertebrate animal (without a backbone) large enough to be seen without magnification and retained by a 500µm mesh (U.S. #30) screen.

Macrophytes	Rooted and floating vascular aquatic plants, commonly referred to as water weeds. These plants usually flower and bear seeds. Some forms, such as duckweed and coontail (*Ceratophyllum sp.*), are free-floating forms not rooted in sediment.
Margin of Safety (MOS)	An implicit or explicit portion of a waterbody's loading capacity set aside to allow the uncertainly about the relationship between the pollutant loads and the quality of the receiving waterbody. This is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The MOS is not allocated to any sources of pollution.
Mass Wasting	A general term for the down slope movement of soil and rock material under the direct influence of gravity.
Mean	Describes the central tendency of a set of numbers. The arithmetic mean (calculated by adding all items in a list, then dividing by the number of items) is the statistic most familiar to most people.
Median	The middle number in a sequence of numbers. If there are an even number of numbers, the median is the average of the two middle numbers. For example, 4 is the median of 1, 2, 4, 14, 16; and 6 is the median of 1, 2, 5, 7, 9, 11.
Metric	1) A discrete measure of something, such as an ecological indicator (e.g., number of distinct taxon). 2) The metric system of measurement.
Milligrams per liter (mg/L)	A unit of measure for concentration in water, essentially equivalent to parts per million (ppm).
Million gallons per day (MGD)	A unit of measure for the rate of discharge of water, often used to measure flow at wastewater treatment plants. One MGD is equal to 1.547 cubic feet per second.
Miocene	Of, relating to, or being an epoch of, the Tertiary between the Pliocene and the Oligocene periods, or the corresponding system of rocks.
Monitoring	A periodic or continuous measurement of the properties or conditions of some medium of interest, such as monitoring a waterbody.
Mouth	The location where flowing water enters into a larger waterbody.
National Pollution Discharge Elimination System (NPDES)	A national program established by the Clean Water Act for permitting point sources of pollution. Discharge of pollution from point sources is not allowed without a permit.
Natural Condition	A condition indistinguishable from that without human-caused disruptions.

Nitrogen	An element essential to plant growth, and thus is considered a nutrient.
Nodal	Areas that are separated from focal and adjunct habitats, but serve critical life history functions for individual native fish.
Nonpoint Source	A dispersed source of pollutants, generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and non-irrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.
Not Assessed (NA)	A concept and an assessment category describing waterbodies that have been studied, but are missing critical information needed to complete an assessment.
Not Attainable	A concept and an assessment category describing waterbodies that demonstrate characteristics that make it unlikely that a beneficial use can be attained (e.g., a stream that is dry but designated for salmonid spawning).
Not Fully Supporting	Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).
Not Fully Supporting Cold Water	At least one biological assemblage has been significantly modified beyond the natural range of its reference condition (EPA 1997).
Nuisance	Anything which is injurious to the public health or an obstruction to the free use, in the customary manner, of any waters of the state.
Nutrient	Any substance required by living things to grow. An element or its chemical forms essential to life, such as carbon, oxygen, nitrogen, and phosphorus. Commonly refers to those elements in short supply, such as nitrogen and phosphorus, which usually limit growth.
Nutrient Cycling	The flow of nutrients from one component of an ecosystem to another, as when macrophytes die and release nutrients that become available to algae (organic to inorganic phase and return).
Oligotrophic	The Greek term for "poorly nourished." This describes a body of water in which productivity is low and nutrients are limiting to algal growth, as typified by low algal density and high clarity.
Organic Matter	Compounds manufactured by plants and animals that contain principally carbon.

Orthophosphate	A form of soluble inorganic phosphorus most readily used for algal growth.
Oxygen-Demanding Materials	Those materials, mainly organic matter, in a waterbody that consume oxygen during decomposition.
Parameter	A variable, measurable property whose value is a determinant of the characteristics of a system, such as temperature, dissolved oxygen, and fish populations are parameters of a stream or lake.
Partitioning	The sharing of limited resources by different races or species; use of different parts of the habitat, or the same habitat at different times. Also the separation of a chemical into two or more phases, such as partitioning of phosphorus between the water column and sediment.
Pathogens	Disease-producing organisms (e.g., bacteria, viruses, parasites).
Perennial Stream	A stream that flows year-around in most years.
Periphyton	Attached microflora (algae and diatoms) growing on the bottom of a waterbody or on submerged substrates, including larger plants.
Pesticide	Substances or mixtures of substances intended for preventing, destroying, repelling, or mitigating any pest. Also, any substance or mixture intended for use as a plant regulator, defoliant, or desiccant.
PH	The negative $\log_{10}$ of the concentration of hydrogen ions, a measure which in water ranges from very acid (pH=1) to very alkaline (pH=14). A pH of 7 is neutral. Surface waters usually measure between pH 6 and 9.
Phased TMDL	A total maximum daily load (TMDL) that identifies interim load allocations and details further monitoring to gauge the success of management actions in achieving load reduction goals and the effect of actual load reductions on the water quality of a waterbody. Under a phased TMDL, a refinement of load allocations, wasteload allocations, and the margin of safety is planned at the outset.
Phosphorus	An element essential to plant growth, often in limited supply, and thus considered a nutrient.
Physiochemical	In the context of bioassessment, the term is commonly used to mean the physical and chemical factors of the water column that relate to aquatic biota. Examples in bioassessment usage include saturation of dissolved gases, temperature, pH, conductivity, dissolved or suspended solids, forms of nitrogen, and phosphorus. This term is used interchangeable with the terms “physical/chemical” and “physicochemical.”

Plankton	Microscopic algae (phytoplankton) and animals (zooplankton) that float freely in open water of lakes and oceans.
Point Source	A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater.
Pollutant	Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.
Pollution	A very broad concept that encompasses human-caused changes in the environment which alter the functioning of natural processes and produce undesirable environmental and health effects. This includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.
Population	A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area.
Pretreatment	The reduction in the amount of pollutants, elimination of certain pollutants, or alteration of the nature of pollutant properties in wastewater prior to, or in lieu of, discharging or otherwise introducing such wastewater into a publicly owned wastewater treatment plant.
Primary Productivity	The rate at which algae and macrophytes fix carbon dioxide using light energy. Commonly measured as milligrams of carbon per square meter per hour.
Protocol	A series of formal steps for conducting a test or survey.
Qualitative	Descriptive of kind, type, or direction.
Quality Assurance (QA)	A program organized and designed to provide accurate and precise results. Included are the selection of proper technical methods, tests, or laboratory procedures; sample collection and preservation; the selection of limits; data evaluation; quality control; and personnel qualifications and training. The goal of QA is to assure the data provided are of the quality needed and claimed (Rand 1995, EPA 1996).
Quality Control (QC)	Routine application of specific actions required to provide information for the quality assurance program. Included are standardization, calibration, and replicate samples. QC is implemented at the field or bench level (Rand 1995, EPA 1996).
Quantitative	Descriptive of size, magnitude, or degree.
Reach	A stream section with fairly homogenous physical characteristics.

Reconnaissance	An exploratory or preliminary survey of an area.
Reference	A physical or chemical quantity whose value is known, and thus is used to calibrate or standardize instruments.
Reference Condition	1) A condition that fully supports applicable beneficial uses with little affect from human activity and represents the highest level of support attainable. 2) A benchmark for populations of aquatic ecosystems used to describe desired conditions in a biological assessment and acceptable or unacceptable departures from them. The reference condition can be determined through examining regional reference sites, historical conditions, quantitative models, and expert judgment (Hughes 1995).
Reference Site	A specific locality on a waterbody that is minimally impaired and is representative of reference conditions for similar waterbodies.
Representative Sample	A portion of material or water that is as similar in content and consistency as possible to that in the larger body of material or water being sampled.
Resident	A term that describes fish that do not migrate.
Respiration	A process by which organic matter is oxidized by organisms, including plants, animals, and bacteria. The process converts organic matter to energy, carbon dioxide, water, and lesser constituents.
Riffle	A relatively shallow, gravelly area of a streambed with a locally fast current, recognized by surface choppiness. Also an area of higher streambed gradient and roughness.
Riparian	Associated with aquatic (stream, river, lake) habitats. Living or located on the bank of a waterbody.
Riparian Habitat Conservation Area (RHCA)	A U.S. Forest Service description of land within the following number of feet up-slope of each of the banks of streams: - 300 feet from perennial fish-bearing streams - 150 feet from perennial non-fish-bearing streams - 100 feet from intermittent streams, wetlands, and ponds in priority watersheds.
River	A large, natural, or human-modified stream that flows in a defined course or channel, or a series of diverging and converging channels.
Runoff	The portion of rainfall, melted snow, or irrigation water that flows across the surface, through shallow underground zones (interflow), and through ground water to creates streams.
Sediments	Deposits of fragmented materials from weathered rocks and organic material that were suspended in, transported by, and eventually deposited by water or air.

Settleable Solids	The volume of material that settles out of one liter of water in one hour.
Species	1) A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2) An organism belonging to such a category.
Spring	Ground water seeping out of the earth where the water table intersects the ground surface.
Stagnation	The absence of mixing in a waterbody.
Stenothermal	Unable to tolerate a wide temperature range.
Stratification	A Department of Environmental Quality classification method used to characterize comparable units (also called classes or strata).
Stream	A natural water course containing flowing water, at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone.
Stream Order	Hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher order streams result from the joining of two streams of the same order.
Storm Water Runoff	Rainfall that quickly runs off the land after a storm. In developed watersheds the water flows off roofs and pavement into storm drains that may feed quickly and directly into the stream. The water often carries pollutants picked up from these surfaces.
Stressors	Physical, chemical, or biological entities that can induce adverse effects on ecosystems or human health.
Subbasin	A large watershed of several hundred thousand acres. This is the name commonly given to 4^{th} field hydrologic units (also see Hydrologic Unit).
Subbasin Assessment (SBA)	A watershed-based problem assessment that is the first step in developing a total maximum daily load in Idaho.
Subwatershed	A smaller watershed area delineated within a larger watershed, often for purposes of describing and managing localized conditions. Also proposed for adoption as the formal name for 6^{th} field hydrologic units.
Surface Fines	Sediments of small size deposited on the surface of a streambed or lake bottom. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 605 mm depending on the observer and methodology used. Results are typically expressed as a percentage of observation points with fine sediment.

Surface Runoff	Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of nonpoint source pollutants in rivers, streams, and lakes. Surface runoff is also called overland flow.
Surface Water	All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors that are directly influenced by surface water.
Suspended Sediments	Fine material (usually sand size or smaller) that remains suspended by turbulence in the water column until deposited in areas of weaker current. These sediments cause turbidity and, when deposited, reduce living space within streambed gravels and can cover fish eggs or alevins.
Taxon	Any formal taxonomic unit or category of organisms (e.g., species, genus, family, order). The plural of taxon is taxa (Armantrout 1998).
Tertiary	An interval of geologic time lasting from 66.4 to 1.6 million years ago. It constitutes the first of two periods of the Cenozoic Era, the second being the Quaternary. The Tertiary has five subdivisions, which from oldest to youngest are the Paleocene, Eocene, Oligocene, Miocene, and Pliocene epochs.
Thalweg	The center of a stream's current, where most of the water flows.
Threatened Species	Species, determined by the U.S. Fish and Wildlife Service, which are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.
Total Maximum Daily Load (TMDL)	A TMDL is a waterbody's loading capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual bases. TMDL = Loading Capacity = Load Allocation + Wasteload Allocation + Margin of Safety. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several waterbodies and/or pollutants within a given watershed.
Total Dissolved Solids	Dry weight of all material in solution in a water sample as determined by evaporating and drying filtrate.

Total Suspended Solids (TSS)	The dry weight of material retained on a filter after filtration. Filter pore size and drying temperature can vary. American Public Health Association Standard Methods (Greenborg, Clescevi, and Eaton 1995) call for using a filter of 2.0 micron or smaller; a 0.45 micron filter is also often used. This method calls for drying at a temperature of 103-105 °C.
Toxic Pollutants	Materials that cause death, disease, or birth defects in organisms that ingest or absorb them. The quantities and exposures necessary to cause these effects can vary widely.
Tributary	A stream feeding into a larger stream or lake.
Trophic State	The level of growth or productivity of a lake as measured by phosphorus content, chlorophyll *a* concentrations, amount (biomass) of aquatic vegetation, algal abundance, and water clarity.
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Turbidity	A measure of the extent to which light passing through water is scattered by fine suspended materials. The effect of turbidity depends on the size of the particles (the finer the particles, the greater the effect per unit weight) and the color of the particles.
Vadose Zone	The unsaturated region from the soil surface to the ground water table.
Wasteload Allocation (WLA)	The portion of receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Wasteload allocations specify how much pollutant each point source may release to a waterbody.

Waterbody	A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.
Water Column	Water between the interface with the air at the surface and the interface with the sediment layer at the bottom. The idea derives from a vertical series of measurements (oxygen, temperature, phosphorus) used to characterize water.
Water Pollution	Any alteration of the physical, thermal, chemical, biological, or radioactive properties of any waters of the state, or the discharge of any pollutant into the waters of the state, which will or is likely to create a nuisance or to render such waters harmful, detrimental, or injurious to public health, safety, or welfare; to fish and wildlife; or to domestic, commercial, industrial, recreational, aesthetic, or other beneficial uses.
Water Quality	A term used to describe the biological, chemical, and physical characteristics of water with respect to its suitability for a beneficial use.
Water Quality Criteria	Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, or industrial processes.
Water Quality Limited	A label that describes waterbodies for which one or more water quality criterion is not met or beneficial uses are not fully supported. Water quality limited segments may or may not be on a §303(d) list.
Water Quality Limited Segment (WQLS)	Any segment placed on a state's §303(d) list for failure to meet applicable water quality standards, and/or is not expected to meet applicable water quality standards in the period prior to the next list. These segments are also referred to as "§303(d) listed."
Water Quality Management Plan	A state or area-wide waste treatment management plan developed and updated in accordance with the provisions of the Clean Water Act.
Water Quality Modeling	The prediction of the response of some characteristics of lake or stream water based on mathematical relations of input variables such as climate, stream flow, and inflow water quality.
Water Quality Standards	State-adopted and EPA-approved ambient standards for waterbodies. The standards prescribe the use of the waterbody and establish the water quality criteria that must be met to protect designated uses.
Water Table	The upper surface of ground water; below this point, the soil is saturated with water.

Watershed	1) All the land which contributes runoff to a common point in a drainage network, or to a lake outlet. Watersheds are infinitely nested, and any large watershed is composed of smaller "subwatersheds." 2) The whole geographic region which contributes water to a point of interest in a waterbody.
Waterbody Identification Number (WBID)	A number that uniquely identifies a waterbody in Idaho ties in to the Idaho Water Quality Standards and GIS information.
Wetland	An area that is at least some of the time saturated by surface or ground water so as to support with vegetation adapted to saturated soil conditions. Examples include swamps, bogs, fens, and marshes.
Young of the Year	Young fish born the year captured, evidence of spawning activity.